



Grade 8
Erosion Investigation
Teacher Guide

Winter 2001

Erosion Investigation Teacher Instructions

Erosion is the physical and chemical process by which Earth's rock and soil are worn down. In this investigation, we will study a chemical process that can erode two common types of rock, limestone and marble. Limestone is a sedimentary rock used for building; marble is a metamorphic rock used to make statues. Both rocks are primarily composed of calcium carbonate, the same mineral used to make chalk and certain fertilizers. Both limestone and marble are easily eroded by weak acid. As such, limestone buildings and marble statues can be eroded by acid rain. As you know, erosion is a relatively slow process to observe. For this classroom investigation of erosion, we will speed up the erosion process by demonstrating the effects of one weak acid, vinegar, on the common classroom example of calcium carbonate, chalk. This investigation demonstrates how changing the amount of vinegar in a solution will affect the breakdown of chalk. In this investigation, students will respond to this question:

How does the amount of vinegar in a solution affect the breakdown of chalk?

Each teacher will be provided with an **Erosion Investigation Teacher Guide**, an **Erosion Investigation Student Report Form** for each student, and the materials necessary to conduct the investigation.

Procedure:

- Step 1** Review this document to help you prepare for classroom discussion.
- Step 2** Collect the necessary materials and practice the investigation yourself to become familiar with the materials and procedures. Display the materials where students will have easy access to them. Allocating the materials in amounts needed by groups of three to four students will leave more class time for the actual investigation.

Note: Schools will receive the vinegar in one quart bottles, along with five 250 ml beakers. Teachers are to provide each group of students 200 ml of vinegar in one of the 250 ml beakers.

Materials (for each group of three to four students):

Provided by MEAP

1. **Erosion Investigation Student Report Forms** (one for each student)
2. 3 clear 250 ml plastic beakers
3. 3 pieces of white chalk (80 to 100 mm long)
4. 200 ml of 5% vinegar
5. plastic device calibrated in milliliters for measuring volume of liquid
6. labels
7. stirring stick

Provided by the School

1. tap water
2. marker or pen

Step 3 Organize the class into investigation groups of three to four students. Distribute or have students pick up the investigation materials.

Step 4 Impress upon students the importance of having a complete **Erosion Investigation Student Report Form** to use as a reference when they take the MEAP science test.

Step 5 Present the question being investigated.

Say: “The purpose of this investigation is to answer the question: **How does the amount of vinegar in a solution affect the breakdown of chalk?**”

Write this question on the board or display it as a poster. Have each student copy the question in the *Question* section (page 3) of his or her student report form.

Step 6 Discuss with students the processes of erosion, distinguishing chemical and physical erosion processes. Emphasize how the use of Earth’s materials, such as rocks for building and art, are subject to the same erosion process as are rocks left undisturbed by humans. Have the students describe types or present examples of erosion and then classify the erosion process as physical (e.g., wind-blown sand) or chemical (e.g., rust). Consider methods used to protect human-made structures from erosion, such as that from rain, freezing, or exposure to chemicals.

Have students write notes describing their previous knowledge about erosion in the *Previous Knowledge* section (page 3) of their report forms.

Step 7 Direct students to complete the *Hypothesis* section (page 3) of their report forms.

Step 8 Review the materials to be used by each student group. Indicate how each will serve in the investigation.

1. beakers — to hold solutions
2. chalk — to place in solutions
3. vinegar and tap water — to make solutions
4. plastic measuring device — to measure volume of solutions
5. labels and marker or pen — to label beakers
6. stirring stick — to stir solutions

Step 9 Have each student group plan and write down the steps it will follow in the *Procedure* section (page 4) of the report form. Say to the students:

“Each group will plan its procedure for conducting the investigation, using the materials I described. I will not help you plan your procedure; however, I will check to see that you have written down all steps in your report form. As you go through your procedure, describe what you observe and record your observations using graphs, tables, or charts in the *Observations/Data/Evidence* section on page 4 of your report form. After you have finished the investigation, complete the *Conclusion* and *Reasons for Error* sections on page 5 of your report form.”

Ask students if they have any general questions about the investigation.

Step 10 Have each group proceed with the investigation. Make sure each student completes his or her report form.

Step 11 Have each group report the results from the investigation to the class. Discuss the answer to the question (i.e., conclusion) and evidence used to support the answer.

Step 12 Have each student complete his or her **Erosion Investigation Student Report Form** and hand it in. Report forms are to be kept in a safe place and returned to the students on the day they take the MEAP science test.

Erosion Investigation Sample Student Responses

This information is provided by MEAP as a reference guide for the **Erosion Investigation Student Report Form**. The format in this document is similar to the format of the **Erosion Investigation Student Report Form**. The sample answers provided may not necessarily reflect your students' work.

MEGOSE Objective(s): EG10, PCM04, C08, C12

Michigan Science Curriculum Framework Benchmarks: V.1MS2, IV.2MS2, I.1MS6, I.1MS2

Question:

How does the amount of vinegar in a solution affect the breakdown of chalk?

Previous Knowledge:

Erosion is a process by which rock and soil are broken down.
Erosion occurs through both physical and chemical change processes.
Sometimes erosion can occur as a by-product of human activity.
The erosion of rock in nature is a relatively slow process.

Hypothesis:

Chalk can be broken down chemically by a weak acid solution. The extent of the breakdown of the chalk is directly related to the strength of the acid solution.

Materials (for each group of three to four students):

1. **Erosion Investigation Student Report Form**
2. 3 clear 250 ml plastic beakers
3. 3 pieces of white chalk (80 to 100 mm long)
4. 200 ml of 5% vinegar
5. plastic device calibrated in milliliters for measuring volume of liquid
6. labels
7. stirring stick
8. tap water
9. marker or pen

Procedure:

1. Label each of the plastic beakers as either:
 - *All Water*
 - *Half Vinegar*
 - *All Vinegar*
2. Put:
 - 120 ml of water in the *All Water* beaker.
 - 60 ml of water and 60 ml of vinegar in the *Half Vinegar* beaker and stir gently.
 - 120 ml of vinegar in the *All Vinegar* beaker.
3. Simultaneously drop one piece of chalk, standing on end, into each of the three beakers. Part of the chalk is in the solution, part is above the solution.
4. Observe any immediate changes taking place on the chalk.
5. Continue to observe the chalk in the solutions for at least 30 minutes. Record observations in the observation chart.

Observations/Data/Evidence (graphs, tables, charts, notes):**Erosion Investigation**

Amount of Vinegar in Beaker	Amount of Bubbling (Reaction Rate)	Observed Erosion Effects
no vinegar	no bubbling	no sign of erosion
half vinegar	some bubbling	some wear of material, pitting
all vinegar	lots of bubbling	lots of wear of material, pitting

Conclusion (include reasons for your conclusion):

Increasing the amount of vinegar in a solution increases the rate of breakdown of chalk.
Water does not appear to chemically react with chalk.

Reasons:

The all water solution caused no observable breakdown of the chalk. The beakers with vinegar showed breakdown of the chalk. The all vinegar solution showed very rapid bubbling as soon as the chalk was added. The half water and half vinegar solution did not bubble as much as the all vinegar solution after immersing the chalk. The chalk in vinegar solutions showed visible sign of breakdown. The chalk in the water solution did not show any sign of breakdown.

Reasons for Error (error analysis):

The temperature of the solution and chalk was not controlled. Perhaps this affected the rate of bubbling in all solutions.

Additional Notes

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